Association between self-reported bruxism activity and occurrence of dental attrition, abfraction, and occlusal pits on natural teeth

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Statement of problem. It is unclear whether subjects who report tooth clenching and/or grinding have more noticeable clinical signs of dental attrition, abfractions, and occlusal pits on their natural teeth than subjects who do not report bruxism activity.

Purpose. The purpose of this study was to determine whether there was an association between self-reported (or not reported) bruxism activity and occurrence of dental attrition (anterior, posterior), abfractions, and occlusal pits on natural teeth.

Material and methods. One hundred and two volunteer adult Greek subjects (mean age 44.6 ±5.7 years) were classified into 2 groups (50 self-reported bruxers and 52 nonbruxers) according to 2 inquires regarding grinding and/or clenching of their teeth. Dental attrition (anterior, posterior) was assessed by 2 calibrated experienced examiners on diagnostic casts on a tooth-by-tooth basis, using a previously well established ordinal scale. Abfraction lesions (V-shaped, in the cervical region) and occlusal pits were recorded if these clinical signs were found on at least 2 natural teeth. Statistical comparisons between the 2 groups relative to the distribution of the occurrence of the 4 clinical signs were performed by means of the exact version of the chi-square test. The Fisher's exact test was used for the comparison of percentages. The intra- and interexaminer reliability was assessed by means of the Cohen's kappa coefficient (α=.05).

Results. The results demonstrated that there was a significant association between self-reported bruxism and occurrence of the 4 clinical signs. Although the 2 groups were significantly different according to the distribution of the 4 clinical signs, the greatest differences occurred for the anterior and posterior attrition signs.

Conclusions. In this study, the occurrence of 4 clinical signs (posterior or anterior dental attrition, abfractions, and occlusal pits) was associated with self-reported bruxers. It is suggested that, primarily, signs of dental attrition may differentiate self-reported bruxers from nonbruxer subjects. (J Prosthet Dent 2008;100:41-46)

Clinical Implications
Although there are no definitively reliable methods for assessing bruxism activity clinically, the use of a bruxism awareness questionnaire combined with observations of dental attrition on diagnostic casts may be used to differentiate self-reported bruxers from nonbruxer subjects.

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Bruxism has been defined as the grinding and/or clenching of teeth during nonfunctional movements of the mandible, thereby regarded as an oral movement disorder.[1-4] It is generally considered to be a diurnal or nocturnal parafunctional activity, which may have potentially damaging consequences for dental, periodontal, and musculoskeletal tissues.[4] A number of clinical signs and symptoms of bruxism have been observed for the structures of the masticatory system, including nonfunctional gnashing or grinding of the teeth in the daytime or during sleep,[3,4] tooth wear,[5,6] hypertrophied masticatory muscles,[7] periodontal disease,[8] and temporomandibular joint pain.[3]

Bruxism activity has been evaluated by several objective measures, such as those obtained with sleep portable electromyography (EMG)[9-11] and polysomnography,[11] although these measuring techniques are not without methodological problems.[12] In addition, these methods are expensive and time consuming and require the patient to sleep in a laboratory environment.[11]

Subjectively, signs of bruxism activity have been assessed in clinical practice and research by means of self-report questionnaires[13,14] and oral history taking (including a bed partner's report of grinding sounds), clinical oral examinations,[15] and observations on diagnostic casts of patients with worn dentitions.[13,16-18] A common clinical feature of all forms of damage caused by bruxism is the loss of enamel or dentin on the occlusal and incisal surfaces (pathological dental attrition), although convincing evidence for the validity of the positive relationship between dental attrition and bruxism is lacking.[19,20]

Several clinical signs have been ascribed to clenching or/and grinding of teeth, such as: dental attrition[5, 21-23] (mechanical wear, resulting from parafunction, and limited to the contacting surfaces of the teeth), abfraction in the cervical region of the teeth,[24] and occlusal pits.[25] In spite of the fact that many of these features are relevant to bruxism activity, little information exists regarding the association between self-reported bruxism and these clinical signs observed on natural teeth. Therefore, the aim of this study was to investigate whether there was an association between self-reported (or not) bruxism activity and occurrence of dental attrition, abfraction, and occlusal pits, observed on diagnostic casts of 2 adult Greek groups. The research hypothesis was that there would be a significant relationship between the self-reported status of bruxism and clinical findings of tooth wear (as defined by 4 measures: anterior attrition, posterior attrition, abfraction lesions, and occlusal pits).

MATERIAL AND METHODS

Participants of the present study were recruited from among the patients being referred to the Fixed and Implant Prosthodontics clinic, Aristotle University of Thessaloniki Dental School, for routine prosthetic rehabilitation during a 20-month period from 2003 to 2005. All participants provided written informed consent for the study protocols, which were approved by the Ethical Committee of Aristotle University of Thessaloniki Dental School. The study was conducted using a questionnaire of bruxism awareness in 102 self-reported bruxism and nonbruxism subjects.

Participants were required to meet the following inclusion criteria: a history of good health with no psychological disorders or epilepsy, and between the ages of 30 and 55 years. All subjects who had more than 2 missing posterior (excluding third molars) or anterior teeth, extensive prosthetic restorations (with more than a 4-unit fixed partial denture for the replacement of 2 missing teeth), subjects currently using prescription medication with a known influence on sleep structure (such as antipsychotic psychotropic drugs), and subjects with inaccurate diagnostic casts were excluded.

Participants were classified into 2 groups (50 self-reported bruxers and 52 nonbruxers), according to their answers to 2 questions: (1) Do you clench your teeth during the daytime? And (2) Has anyone heard you grinding your teeth at night? In the context of this study, the term *self-reported bruxism activity* referred to patients' awareness about clenching their teeth and/or tooth grinding sounds reported by a bed partner or immediate family member.

Test-retest reliability of answers was evaluated by repeating the questionnaire regarding awareness of bruxism within the subsequent 4 weeks to a group of 40 subjects selected from the original sample of 102 subjects. The study was based on examination of diagnostic casts made of the dental arches of 102 subjects. Initially, irreversible hydrocolloid impressions (Alginoplast, fast set; Heraeus Kulzer, Hanau, Germany) were made, and the impressions were cast in vacuum-mixed super-hard stone (Picodent hydro-plaster, type IV dental stone; Picodent, Wipperfürth, Germany), resulting in a set of maxillary and mandibular casts for each participant. Clinical signs were assessed on accurate diagnostic casts. In a few situations in which the casts were inaccurate, new casts were fabricated. Assessment of occurrence and severity of attrition of incisal edges of the anterior teeth and occlusal surfaces of posterior teeth (incisal/occlusal morphology changed in shape or was totally lost locally/generally with height reduction of teeth) was performed by 2 experienced clinicians on the diagnostic casts on a tooth-by-tooth basis, using the previously established ordinal scale by Johansson et al[26,27] (Fig. 1). The identification of dental attrition was confirmed if the wear facets of hand-articulated diagnostic casts matched.[28,29] In addition, intraoral photographs (as well as a complete arch view of diagnostic casts) were made in some instances to allow a more detailed assessment of occlu-

sal/incisal wear facets, using a digital camera (Nikon camera, D200; Nikon Corp, Tokyo, Japan).

Abfractions, visible V-shaped vestibular lesions, were recorded if they were found at the cemento-enamel region of at least 2 teeth per subject[30,31] (Fig. 2). Similarly, occlusal pits, defined as unique concavities (rounded depressions, also described as inverted cupolas), were recorded if found on the occlusal surfaces of at least 2 posterior teeth[25] (Fig. 1). All evaluations were performed by 2 experienced clinicians in nearly standardized lighting conditions. The examination of clinical signs on diagnostic casts occurred in a daylight-isolated room with artificial light (60-W spotlight). At the start of the present study, the 2 dental examiners held a series of sessions to standardize the assessment of dental signs (dental attrition, abfraction, and occlusal pits) on diagnostic casts, and were able to attain high levels of rating reproducibility and interexaminer reliability. In particular, the training and calibration sessions focused on the agreement of the 2 examiners in relation to the recognition of the occlusal/incisal wear pattern according to Johansson's scale (grades 1 and 2)[26,27] on at least 4 teeth per subject. Grade 1 corresponds to altered occlusal/incisal morphology with anatomic details faded, and grade 2 corresponds to shape changes in occlusal/incisal morphology, with some loss of crown height. The abfractions were recorded without gradation of lesion depth and width. Initially, the 2 dental examiners were calibrated on 10 pairs of diagnostic casts, and 3 weeks later, 10 additional pairs of casts were selected from the total sample and were assessed independently by the same 2 examiners.

Since the grouping of the patients did not occur according to a randomization process and the total sample was not collected by means of an established random sampling scheme, the usual parametric and nonparametric tests were not used. The statistical comparisons between the 2 groups
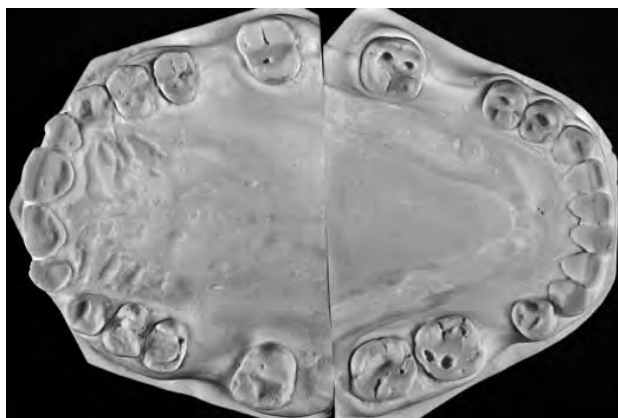
1 Anterior and posterior (flattening of cusps) attrition with change of incisal/occlusal surfaces. Note occlusal pits on molar and premolar teeth.

2 V-shaped abfractions in cervical region.

of the distribution of the occurrence of the 4 clinical signs were performed by means of the exact version of the chi-square test. More specifically, the Fisher's exact test was used for the comparison of the corresponding percentages. The comparison of the patients' age distribution among the 2 groups was accomplished by the exact version of the Mann-Whitney test. The observed significance level (*P* value) of all statistical tests (chi-square and Mann-Whitney) was computed using the Fisher's exact method.[32,33] The goal of this statistical approach was to enable the investigators to make reliable inferences in situations in which the available data were small (and, consequently, the large sample theory was in doubt), sparse, heavily tied, or unbalanced, and the validity of the usual assumptions (such as randomness of the sample and independence of observations) underly-

ing the corresponding statistical tests was not met.[34] All the statistical analyses were performed using statistical software (SPSS 13.0; SPSS, Inc, Chicago, Ill) enhanced with the module exact tests. The significance level of all statistical tests was predetermined at $\alpha=.05$.

RESULTS

The sample consisted of 102 Greek subjects (mean age 44.6 ±5.7 years) of whom 54 were men and 48 were women. The mean (SD) age of self-reported bruxers was 45.4 (4.4) years and the mean age for nonbruxers was 43.9 (6.7) years. No significant differences were detected between the ages of the 2 groups (Mann-Whitney U=443.5, Z=-0.853, *P*=.398). The test-retest reliability of answers for self-reported bruxism subjects and nonbruxers revealed an exact agree-

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ment (100%). The intraexaminer reliability levels varied from 0.80 to 0.90, and the interexaminers' reliability ranged from 0.80 to 0.86, using Cohen's kappa coefficient in both situations.

From Table I, it is evident that there was a significant association between the reported status of bruxism and the occurrence of 4 clinical signs (abfraction lesions, occlusal pits, and posterior and anterior dental attrition). The self-reported bruxing group demonstrated relatively more positive clinical signs than the nonbruxing group, considering the negative signs, also. The distribution of each of the 4 clinical signs was significantly different between the 2 study groups (all 4 P values were <.05, Table I). The greatest differences between the 2 groups were for the relative occurrence of the clinical signs of attrition in the anterior and posterior regions.

TABLE I. Comparison of 2 groups (self-reported bruxers, nonbruxers) relative to occurrence or no occurrence of 4 clinical signs

		Clinical Signs		
Group		Abfraction		
		Negative	Positive	Total
SR bruxers	Subjects	33	17	50
	%	66	34[a]	100
Nonbruxers	Subjects	44	8	52
	%	84.6	15.4[b]	100
$\chi^2(1)=4.774$	Total	77	25	102
$P=.038$	%	75.5	24.5	100
Group		Occlusal Pits		
		Negative	Positive	Total
SR bruxers	Subjects	17	33	50
	%	34	66[a]	100
Nonbruxers	Subjects	32	20	52
	%	61.5	38.5[b]	100
$\chi^2(1)=7.744$	Total	49	53	102
$P=.006$	%	48	52	100
Group		Attrition Anterior		
		Negative	Positive	Total
SR bruxers	Subjects	12	38	50
	%	24	76[a]	100
Nonbruxers	Subjects	32	20	52
	%	61.5	38.5[b]	100
$\chi^2(1)=14.644$	Total	44	58	102
$P=.001$	%	43.1	56.9	100
Group		Attrition Posterior		
		Negative	Positive	Total
SR bruxers	Subjects	21	29	50
	%	42.0	58.0[a]	100
Nonbruxers	Subjects	44	8	52
	%	84.6	15.4[b]	100
$\chi^2(1)=20.026$	Total	65	37	102
$P=.001$	%	63.7	36.3	100

For each clinical sign, group percentages, corresponding to positive clinical signs, followed by different superscripted lowercase letters, are significantly different ($P<.05$), according to Fisher's Exact test.

DISCUSSION

The results supported the research hypothesis that there would be a significant relationship between the self-reported status of bruxism and clinical findings of tooth wear as defined by 4 measures: anterior attrition, posterior attrition, abfraction lesions, and occlusal pits.

A simple yes/no questionnaire concerning the awareness of bruxism was used in the present study to classify a sample of 102 Greek subjects into 2 groups (self-reported bruxers and nonbruxers). Although there is inadequate support for the use of participants' self-report of bruxism as a diagnostic tool,[35] the questionnaire has been used in epidemiological studies in which the association between bruxism and temporomandibular joint pain or tooth wear was investigated.[14,36] The principal advantage of the questionnaire is that it can be applied to a large population, though the information on bruxism activity is subjective in nature. Previous studies by questionnaire and interviews related to oral parafunctions have reported that approximately 8 to 20% of the population are aware of clenching and/or grinding their teeth.[22,36] Other authors have found a higher prevalence (31.4%) of self-reported grinding and/or clenching of teeth in a sample of 483 adult subjects.[37]

In the present study, the occurrence of noticeable anterior-posterior dental attrition signs, abfractions (loss of dental hard tissue appearing as V-shaped lesions in the cervical region of the teeth), and occlusal pits on the occlusal surfaces of the posterior teeth was evaluated by 2 experienced calibrated clinicians on accurate diagnostic casts of 2 adult Greek groups. Although a number of methods to assess bruxism activity and dental attrition, including clinical examination and direct visual observations intraorally,[15] occlusal devices (bruxcore plate),[38] computer graphics and the use of profilometry,[39] and observa-

tions on accurate diagnostic casts,[13,16] have been reported in the literature, they have not achieved universal acceptance. Of the methods available to evaluate the occurrence of dental attrition, it has been suggested that the use of diagnostic casts is among the most accurate in clinical settings.[27] However, it is difficult to ensure if dental attrition is a consequence of mastication or a parafunctional activity, because it has a multifactorial etiology.[20]

In the present study, diagnostic casts of 102 subjects were examined for the occurrence of noticeable anterior and posterior attrition with a method described by Johansson et al.[26,27] This method may be more efficient to use in clinical practice than intraoral inspection alone because the evaluation of diagnostic casts enables a more detailed examination of the location, severity, and extent of worn teeth.[16,27] Intra- and interexaminer reliability are essential for the usefulness of this method, and the reliability of these approaches has been also confirmed in previous studies.[27,28]

The results of this study demonstrate that although the 2 groups (self-reported bruxers and nonbruxers) were significantly different according to the distribution of the 4 clinical signs, the greatest differences occurred for the anterior and posterior signs of attrition (Table I). This finding, the significant association between dental attrition and bruxism awareness, is in agreement with previous studies which have shown an association between tooth wear and self-reported bruxism.[18,23,40] However, other studies have not found a significant association between self-reported bruxism activity and tooth wear.[13,16,19] Marbach et al[19] found that only 34.4% of the self-reported bruxers showed evidence of tooth wear, and the authors suggested that evidence of tooth wear does not necessarily indicate bruxism activity. Differences in samples and methods available to evaluate dental attrition (and tooth wear), as well as the possibility that subjects are not

able to assess their own bruxism activities accurately,[35] make it difficult to compare the results of this study and previous investigations. Although most patients are unaware of the noises generated by the grinding of their teeth while sleeping, bed partners or immediate family members generally complain about its effect on the quality of their sleep.

The percentage of abfraction lesions was greater in self-reported bruxers, but the difference between the 2 groups was not clinically significant (Table I). These results are in agreement with previous findings.[30,41] It is likely that abfraction lesions have a multifactorial etiology and that high occlusal loading may contribute to the loss of hard tissue in the cervical region.[30] The association between self-reported bruxism and the pits on the occlusal surfaces (of at least 2 posterior teeth) was statistically significant. The occurrence of this clinical sign was primarily in the group of self-reported bruxers (Table I).

A limitation of this study was the use of the self-report questionnaire which may not accurately detect the presence of bruxism, a subconscious parafunctional behavior. An additional potential limitation was the impartiality of self-reported bruxism activity and the possibility of confounding, due to the subjects having been told by their dentist in the past that they were bruxers.[17,19] Finally, it is not clear how these findings apply to interexaminer reliability of an overall assessment of tooth wear signs among a group of dentists who have not been trained to use the specific incisal/occlusal wear scale. For this reason, overestimation or underestimation of the association between self-reported bruxism activity and clinical signs may occur. More research is needed for the establishment of definitively reliable methods for assessing current bruxism in the clinic. The use of appropriate tooth wear measures remains controversial because the clinical signs of bruxism may reflect a problem in the past rather than in the present.

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CONCLUSIONS

Within the limitations of this study, the following conclusions were drawn:

1. The findings of this study suggested a significant association between the self-reported status of bruxism and the occurrence of 4 clinical signs (abfraction lessions, occlusal pits, and dental attrition in posterior and anterior regions). The 4 clinical signs were significantly more frequent in self-reported bruxers than non-bruxer subjects.

2. The distribution of the 4 clinical signs was found to be significantly different between the 2 study groups (self-reported bruxers and nonbruxers). The greatest differences between the 2 groups were found for the relative occurrence of the anterior and posterior attrition signs. This finding suggests that, primarily, the signs of dental attrition may differentiate self-reported bruxers from nonbruxers.

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